$$\therefore y = -\frac{61a^4b}{360EI} = \text{deflection required.}$$

For cantilever beam, length $2a$, with the same load,

$$EI\frac{d^2y}{dx^2} = -A(x-z) = -\frac{2bx^3}{3a} + \frac{bx^4}{4a^2},$$

$$EI\frac{dy}{dx} = -\frac{bx^4}{6a} + \frac{bx^5}{20a^2} + C; \text{ when } x=2a,\ dy/dx=0,\ C=\tfrac{16}{15}a^3b.$$

$$\therefore EI\frac{dy}{dx} = -\frac{bx^4}{6a} + \frac{bx^5}{20a^2} + \tfrac{16}{15}a^3b.$$

$$EIy = -\frac{bx^5}{30a} + \frac{bx^6}{120a^2} + \tfrac{16}{15}a^3bx = \tfrac{24}{15}a^4b, \text{ when } x=2a.$$

$$\therefore y = \frac{24a^4b}{15\,EI} = \text{deflection at end of beam.}$$

Also solved by Harold Rowe.

242. Proposed by C. N. SCHMALL, 604 East 5th Street, New York City.

In a certain New York theatre there is an asbestos curtain supported by thin circular rings, radius r, which move on a cylindrical rod of radius a. The curtain is intended to be drawn by a *steady pull.* Taking μ as the coefficient of friction, show that this will not be possible if r be less than $a\sqrt{(1+\mu^2)}$.

Solution by G. B. M. ZERR, A. M., Ph. D., Philadelphia, Pa.

Let P be the resultant pull on a ring, θ the angle between the direction of P and the normal to the surface of contact of ring and rod.

Then $P\cos\theta$=resolved part of P along the normal, and $P\sin\theta$=resolved part at right angles to the normal. For equilibrium, $P\sin\theta < \mu P\cos\theta$.

$$\therefore \sin^2\theta < \mu^2\cos^2\theta, \text{ or } \cos^2\theta > \frac{1}{1+\mu^2}.$$

The diameter of the ring is in the direction of P; diameter of rod is the normal.

$$\therefore \cos\theta = \frac{a}{r}. \quad \therefore \frac{a^2}{r^2} > \frac{1}{1+\mu^2} \text{ or } r < a\sqrt{(1+\mu^2)}.$$

243. Proposed by G. B. M. ZERR, A. M., Ph. D., Philadelphia, Pa.

A weight W is supported by three strings of the same size and quality lying in the same plane. The middle string is vertical, one string makes with it an angle θ on one side, and the other string makes with it an angle ϕ on the other side. Find the stresses T_1, T_2, T_3 in the strings.